National Aeronautics and
Space Administration

Instrumentation

Deconvolution Approach for the Mapping of Acoustic Sources (DAMAS)

Noise location and strength diagnostics for mechanical/aerodynamic systems

NASA's Langley Research Center researchers developed DAMAS using an iterative algorithm to deconvolute noise signals, allowing for more accurate quantification of the position and strength of acoustic sources. Recent development of the DAMAS microphone phased array processing methodology allows the determination and separation of coherent and incoherent noise source distributions. The DAMAS technology represents a significant breakthrough in the field of aero-acoustics.

BENEFITS

- Replaces traditional presentations of array results and makes the array a much more powerful measurement tool than is presently the case
- Decouples the array design influence from the noise measured
- Solves acoustic problems not approachable by other methods

APPLICATIONS

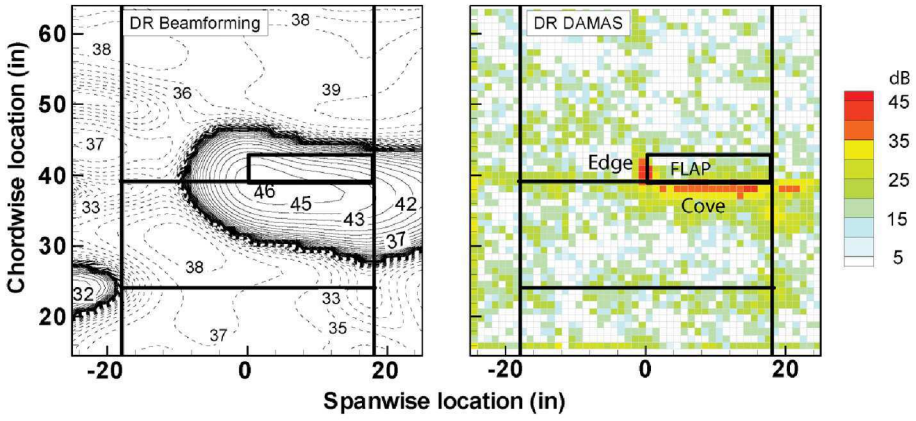
- Aerospace and transportation:
  -- noise and vibration control
  -- flap edge/cove, trailing edge, leading edge, slat, landing gear, and calibration noise sources
  -- jet and turbomachinery noise
  -- general noise source localization and quantification
- Instrumentation - music and environmental acoustics

technology solution

THE TECHNOLOGY

In 2004, NASA developed a deconvolution approach for the mapping of acoustic sources (DAMAS) that decoupled the array design and processing influence from the noise being measured, using a simple and robust algorithm. DAMAS does not add any additional assumption to traditional array processing/integration analysis. It merely extracts the array characteristics from the source definition presentation. In 2005, three-dimensional applications of DAMAS were examined. DAMAS was shown to render an unambiguous quantitative determination of acoustic source position and strength.

The present development, called DAMAS-C, extends the basic approach to include coherence definition between noise sources. The solutions incorporate cross-beamforming array measurements over the survey region. While the resulting inverse problem can be large and the iteration solution computationally demanding, DAMAS-C solves problems no other technique can approach. DAMAS-C is validated using noise source simulations and is applied to airframe flap noise test results.



A comparison example of array processing methodology for an acoustic wing/ flap test model test. On the left is a contour map for a standard array beamforming method and on the right is the explicit noise source distribution determined from DAMAS, for the same case.

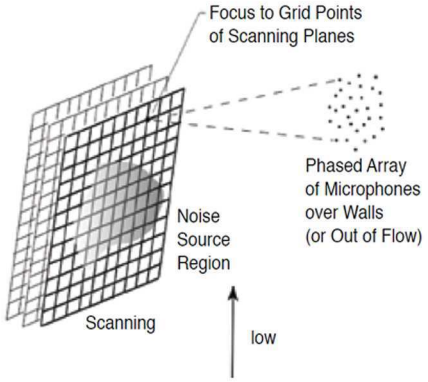


Illustration of open jet test configuration where the array is out of flow and the scanning plane is positioned over aeroacoustic source region.

PUBLICATIONS

Patent No: 7,783,060; 8,170,234

More Information

National Aeronautics and Space Administration

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